ANTISTATIC STRUCTURE OF FUEL PIPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an antistatic structure for preventing a fuel pipe from being charged in contact with a fuel that has been charged by friction with a fuel pipe or a strainer.

2. Description of the Related Art

A fuel tank for an automobile is provided with a strainer for removing foreign matters in a fuel and various pipes such as a feed pipe, a return pipe, and a vent pipe. The feed pipe feeds a fuel to an injector of an engine. The return pipe returns, to a fuel tank, an excess fuel which is not jetted from the injector in the engine. The vent pipe is connected to a filler tube at an upper space of the fuel tank so as not to prevent the injection of the fuel from the filler tube to the fuel tank. If the fuel is charged by friction when flowing in the pipes or the strainer, the pipes are charged in contact with the fuel. If the pipes are thus charged, a difference in potential might be made between the body side and the pipes to generate a discharge.

JP-A-2000-266240 has described such a structure that pipes such as a fuel pipe, a brake pipe, a power steering pipe and a lubricating oil pipe are collectively supported on a piping holding portion formed of a conductive resin and the piping

holding portion is fixed to a vehicle body through a bracket and a bolt which are formed of a metal, thereby transferring electric charges accumulated in the pipes to the vehicle body.

However, there has conventionally been a problem in that a special member such as the bracket or the bolt is required for fixing the piping holding portion formed of the conductive resin to the vehicle body in the state of electrical connection, resulting in an increase in the number of parts.

SUMMARY OF THE INVENTION

In consideration of the circumstances, it is an object of the invention to remove electric charges from a fuel pipe charged in contact with a fuel by using a simple structure.

In order to attain the object, a first aspect of the invention is directed to an antistatic structure of a fuel pipe wherein the fuel pipe to be charged in contact with a fuel, and a pipe connected electrically to a vehicle body are coupled to each other through a conductive clamp in at least one portion.

According to the structure described above, the fuel pipe and the pipe are coupled to each other through the conductive clamp in at least one portion. Therefore, it is possible to transfer the electric charges of the fuel pipe charged in contact with a fuel to the body through the conductive clamp and the pipe. Consequently, it is possible to suppress the generation of a great discharge, thereby preventing a deterioration in the

fuel pipe. Moreover, the pipe is originally connected electrically to the body. Therefore, a special member for electrically connecting the conductive clamp to the body is not required so that the number of parts and cost can be reduced.

In addition to the structure according to the first aspect of the invention, moreover, a second aspect of the invention is directed to the antistatic structure of a fuel pipe, wherein the conductive clamp couples portions of the fuel pipe and the pipe that are disposed close to each other in parallel.

According to the structure described above, the portions in which the fuel pipe and the pipe are provided close to each other in parallel are connected through the conductive clamp. Therefore, the conductive clamp can have a small and simple structure.

In addition to the structure according to the first aspect of the invention, furthermore, a third aspect of the invention is directed to the antistatic structure of a fuel pipe, wherein the pipe is a brake pipe, and the brake pipe is electrically connected to the vehicle body through a bracket for supporting a connecting portion to a brake hose.

According to the structure described above, the brake pipe is electrically connected to the vehicle body through a bracket for supporting a connecting portion to a brake hose. Therefore, a special member for electrically connecting the brake pipe to the body is not required so that the number of parts and cost

can be reduced.

In addition to the structure according to the first aspect of the invention, moreover, a fourth aspect of the invention is directed to the antistatic structure of a fuel pipe according to the first aspect of the invention, wherein the conductive clamp is constituted by a synthetic resin including carbon black.

According to the structure described above, the conductive clamp is constituted by a synthetic resin including carbon black. Therefore, it is possible to cause the conductive clamp to have a flexibility to easily clamp the fuel pipe and the pipe, and furthermore, to reliably carry out electrical conduction between the fuel pipe and the pipe.

A feed pipe 12 and a return pipe 13 according to an embodiment corresponds to the fuel pipe according to the invention and a wall portion 22 according to the embodiment corresponds to the body according to the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing a fuel feeding system and a brake system in an automobile;

Fig. 2 is an enlarged view taken along in a line 2 - 2 of Fig. 1;

Fig. 3 is an enlarged view seen from a direction 3 of Fig. 1; and

Fig. 4 is a sectional view taken along a line 4 - 4 of

Fig. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the invention will be described below based on an embodiment of the invention shown with reference Figs. 1 to 4.

As shown in Fig. 1, a fuel tank 11 is mounted on a rear part of a vehicle body of a vehicle, and the fuel tank 11 and an engine E mounted on the front part of the body are connected to each other through a feed pipe 12 and a return pipe 13. The feed pipe 12 for feeding a fuel to the engine E has an upstream end connected to a strainer and a fuel pump which are provided in the fuel tank 11 and are not shown, and a downstream end connected to an injector which is provided in the engine E and is not shown. The return pipe 13 for returning an excess fuel from the engine E to the fuel tank 11 has an upstream end connected to the injector and a downstream end connected to the upper space of the fuel tank 11.

Brake calipers 14FL, 14FR, 14RL and 14RR are provided on left and right front wheels WFL and WFR to be driving wheels connected to the engine E through a transmission T and left and right rear wheels WRL and WRR to be driven wheels which rotate with the running of the vehicle, respectively. A tandem type master cylinder 17 to be operated by a brake pedal 15 through a vacuum booster 16 has a first port 17a connected to the brake

caliper 14FR of the right front wheel WFR and the brake caliper 14RL of the left rear wheel WRL through two brake pipes 18FR and 18RL, and a second port 17b connected to the brake caliper 14FL of the left front wheel WFL and the brake caliper 14RR of the right rear wheel WRR through two brake pipes 18FL and 18RR.

The three pipes, that is, the feed pipe 12, the return pipe 13 and the brake pipe 18RL of the left rear wheel WRL are arranged close to each other in parallel and extends in a longitudinal direction along the lower surface of the floor of the vehicle in this state. The three pipes 12, 13 and 18RL are put together through a plurality of (five in the embodiment) clamps 19 ··· and 20. While the four clamps 19 ··· are constituted by a general synthetic resin which is not conductive, one conductive clamp 20 is constituted by a conductive synthetic resin containing carbon black.

As shown in Fig. 2, the conductive clamp 20 fixes the feed pipe 12 to be fitted in a concave portion 20a formed on a center with an elastic attachment piece 20b, fixes the return pipe 13 to be fitted in a concave portion 20c formed on one end side with an elastic attachment piece 20d, and fixes the brake pipe 18RL to be fitted in a concave portion 20e formed on the other end side with a pair of elastic attachment pieces 20f and 20g. Accordingly, the feed pipe 12, the return pipe 13 and the brake pipe 18RL are electrically conducted mutually through the conductive clamp 20.

As is apparent from Figs. 1, 3 and 4, a bracket 23 is welded to a wall portion 22 of a wheel well 21 of the left rear wheel WRL. A hose fixture 25 is provided on one of ends of a flexible brake hose 24 having the other end coupled to the brake caliper 14RL, and a groove portion 25c formed between a lower flange 25a and an upper flange 25b in the hose fixture 25 is loosely fitted in an opening 23a of the bracket 23. On the other hand, a pipe fixture 26 is provided on the end of the brake pipe 18RL. The pipe fixture 26 can be threadedly fixed onto the hose fixture 25 by means of a wrench 27. Accordingly, after the pipe fixture 26 is fastened to the hose fixture 25, a clip 28 is pressed into a clearance between the lower surface of the upper flange 25b of the hose fixture 25 and the upper surface of the bracket 23 so that the hose fixture 25 can be fixed to the bracket 23. In this state, the brake pipe 18RL is electrically conducted to the wall portion 22 of the wheel well 21 through the pipe fixture 26, the hose fixture 25, the clip 28 and the bracket 23.

Actually, the brake hoses are connected to the ends of the three other brake pipes 18FL, 18FR and 18RR and the brake hoses are not shown in Fig. 1.

Next, description will be given to functions according to the embodiment of the invention having the structure described above.

When a fuel flowing in the feed pipe 12 and the return pipe 13 or in the strainer provided on the upstream side of the

feed pipe 12 is charged by friction, the feed pipe 12 and the return pipe 13 which come in contact with the fuel are charged. However, the feed pipe 12 and the return pipe 13 are electrically connected to the brake pipe 18RL through the conductive clamp 20, and furthermore, the brake pipe 18RL is electrically connected to the wall portion 21 of the vehicle body through the bracket 23 in a connecting portion to the brake pipe 24. Therefore, it is possible to transfer electric charges accumulated in the feed pipe 12 and the return pipe 13, thereby reliably eliminating the electric charges.

Consequently, it is possible to reliably prevent a great discharge from being generated due to a gradual increase in the amount of charging and to prevent the feed pipe 12 and the return pipe 13 from being deteriorated due to the discharge. Thus, a durability of pipes can be enhanced. In addition, the conductive clamp 20 can be deformed elastically. Therefore, the change of positions of the feed pipe 12, the return pipe 13 and the brake pipe 18RL and vibrations thereof can be absorbed effectively, and furthermore, each of the pipes 12, 13 and 18RL can easily be inserted into the conductive clamp 20, so that a contact failure is seldom caused. Moreover, the conductive clamp 20 can be electrically connected to the vehicle body by utilizing the brake pipe 18RL and the bracket 23 which is previously provided to support the end of the brake pipe 18RL on the vehicle body. Consequently, it is not necessary to

specially provide a member for electrically connecting the conductive clamp 20 to the body, so that the number of parts can be reduced. Furthermore, the conductive clamp 20 clamps portions in which the feed pipe 12, the return pipe 13 and the brake pipe 18RL are arranged close to each other in parallel. Therefore, the conductive clamp 20 can have a small and simple structure.

While the embodiment of the invention has been described above in detail, the invention can be variously designed and changed without departing from the scope thereof.

For example, while the feed pipe 12 and the return pipe 13 are electrically connected to the vehicle body by utilizing the brake pipe 18RL communicating with the brake caliper 14RL of the left rear wheel WRL in the embodiment, any of the brake pipes 18FL, 18FR and 18RR may be utilized. Although only one conductive clamp 20 has been used in the embodiment, it is more effective that two or more conductive clamps 20 are used to prevent a contact failure. Moreover, the shape of the conductive clamp 20 is not restricted to that of the embodiment but can be changed properly. More specifically, each pipe is not provided on one plane but can be arranged annularly. Moreover, the fuel pipe is not restricted to the feed pipe 12 and the return pipe 13 but other pipes such as a vent pipe may be used.

As described above, according to the first aspect of the invention, the fuel pipe and the brake pipe are coupled to each

other through the conductive clamp in at least one portion. Therefore, it is possible to transfer the electric charges of the fuel pipe charged in contact with a fuel to the vehicle body through the conductive clamp and the brake pipe. Consequently, it is possible to suppress the generation of a great discharge, thereby preventing a deterioration in the fuel pipe. Moreover, the brake pipe is originally connected electrically to the vehicle body. Therefore, a special member for electrically connecting the conductive clamp to the body is not required so that the number of parts and cost can be reduced.

According to the second aspect of the invention, the portions in which the fuel pipe and the brake pipe are provided close to each other in parallel are connected through the conductive clamp. Therefore, the conductive clamp can have a small and simple structure.

According to the third aspect of the invention, the brake pipe is electrically connected to a vehicle body through a bracket for supporting a connecting portion to a brake hose. Therefore, a special member for electrically connecting the brake pipe to the vehicle body is not required so that the number of parts and cost can be reduced.

According to the fourth aspect of the invention, the conductive clamp is constituted by a synthetic resin containing carbon black. Therefore, it is possible to cause the conductive clamp to have a flexibility to easily clamp the fuel pipe and

the brake pipe, and furthermore, to reliably carry out electrical conduction between the fuel pipe and the brake pipe.